

NASA TECH BRIEF

Ames Research Center



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Spacecraft Oxygen Recovery System

The results of preliminary tests indicate good performance by an oxygen recovery system which is comprised of three integrated subsystems: an electrochemical carbon dioxide concentrator which removes carbon dioxide from the atmosphere, a Sabatier reactor in which carbon dioxide is reduced with hydrogen to form methane and water, and a static-feed water electrolysis cell to recover oxygen from the water. Hydrogen generated in the cell is reused in the carbon dioxide concentrator, and the methane from the Sabatier reactor is a system byproduct.

The carbon dioxide concentrator can maintain the partial pressure of carbon dioxide in the cabin air below 3mm of mercury with demonstrated long-term reliability. The Sabatier reactor has a high conversion efficiency and can be operated either with a hydrogen-rich or with a carbon dioxide-rich gas mixture (dry or humid). The static-feed water electrolysis cell has been shown to be reliable over long periods of time (>10,000 hrs continuous operation); it can be operated at high current densities (to 0.48 A/cm²).

A rebreather system, utilizing the carbon dioxide concentrator and the electrolysis cell subsystems, has undergone successful flight tests in aircraft; the subsystems were combined with the Sabatier reactor to provide an integrated oxygen recovery system. In tests of the integrated oxygen recovery system, it was shown that the Sabatier reactor operated at highest efficiency when the entire exhaust of the anode from the carbon dioxide concentrator was used (CO₂-rich CO₂/H₂).

Reference:

Quattrone, P. D.: Spacecraft Oxygen Recovery System. *Astronautica Acta*, vol. 18, p. 261, 1973.

Notes:

1. Additional information on subsystems and components may be found in the following NASA Tech Briefs:
B71-10203, Water Electrolysis Module.
B72-10051, Improved Device Measures Performance of Batteries under Load.
B72-10074, Oxygen Pressure Control for Electrolysis Cells.
B72-10194, Carbon Dioxide Concentrator.
B72-10195, Aircrew Oxygen System.
B72-10219, Counter Lung.
B72-10246, Water Cavity Degasser for Electrolysis Cells.
2. No additional documentation is available. Specific questions, however, may be directed to:
Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: B74-10220

Patent status:

NASA has decided not to apply for a patent.

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Category 05